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Technology-Infused Science Education Curriculum for Parents to Teach Kindergarten Children

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Technology-Infused Science Education Curriculum for Parents to Teach Kindergarten Children

by

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Report

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Dedication

To my parents, Chencheng Ma, Chanfeng Ma, my husband, Xiao Chen, my professors and my mentors who gave me support in different ways and encouraged me to further my education in the USA and pursue my passion for education.

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Abstract

Technology-Infused Science Education Curriculum for Parents to Teach Kindergarten Children

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As technology advances and becomes an integral part of our life, concerns arise because of the inequity technology has unintendedly created especially reflected in the form of usage gap between different groups of learners and families. Parents who have young children and less knowledge of digital literacy and skills are suffering more from anxieties about children's screen time and technology use at home. In terms of content area learning, there is a severe lack of quality science education resources for young children and that hinders children's early exposure to science literacy. In this report, I reviewed research-based evidence for the need to develop technology-infused science education resources for parents of young children and then created a series of 10 lesson plans to help parents gain insights about technology integration for science learning at home for young kids and increase their confidence about the value of technology when used in content-rich ways.

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Chapter 1: Introduction

Education equity has become an increasingly emphasized topic in recent years as it is perceived as an essential means to provide equal opportunities for all. The use of educational technology which is getting more and more pervasive today, was proven by many research studies to impact positively on learning outcomes especially for students from lower socioeconomic status (Barton, 2003) and once hoped to be the way to democratize access to opportunities in education for all (Reich & Ito, 2017). Unfortunately, the open access to free online learning materials attributed by ubiquitous digital devices and online networks at much-reduced cost and the use of technology in learning have been accused of creating a digital divide (Reich & Ito, 2017; Vigdor & Ladd, 2010) primarily reflected in the form of access gap, usage gap, and literacy gap between the affluent and the disadvantaged people. The National Education Technology Plan (US Department of Education, 2017) defined the access gap in terms of the varied level of access to digital devices and internet at school and home while referring the usage gap to the difference between active ways to transform learning and passive ways for information consumption using technology. The digital literacy gap can be defined as the differences in the skills and competencies required of the learners to read, write, and make meaning multimodally in diverse media using digital technologies (Sefton-Green, Marsh, Erstad, & Flewitt, 2016).

There had been significant progress towards closing the access gap by 2006 (Judge, Puckett & Cabuk, 2006), but the issue of digital divide remains prevalent especially in terms of usage gap and literacy gap according to the National Education Technology Plan (U.S. Department of Education, 2017). Most innovations and interventions related to educational technologies currently focus more on teachers and students, but less for helping parents become confident digital mentors, even though the guidance or lack thereof from

parents at home is one of the main contributors to the digital usage gap (Huang, Li, Chen, & Straubhaar, 2018) since parents' technology-related knowledge and skills directly affect how much and how effectively their children use technology at home. In fact, the debate amongst parents about screen time and technology for children has become ever more heated and divisive (Orben, Etchells & Przybylski, 2018) as a result of the lack of research-based guidance on digital parenting skills and the internal anxiety of parents toward the use of screen and technology.

On the science education landscape, despite the consensus on the importance of exposure to science literacy at early age for children (Moomaw, 2012), many early childhood educators remain reluctant to teach science due to the perception of science being difficult to teach combined with the scarcity of teaching resources for science in the early childhood sector (Sackes, 2014; Anderson & Gullberg, 2014). The whole situation of the lack of free quality science education resources and reliance on paid external science enrichment programs for science exposure makes it even harder for the disadvantaged parents to have equitable access to science education materials or expose their children to science literacy early which is critical for helping children cultivate an interest in the subject. Research has shown a strong and positive correlation between learning outcomes and parental involvement during periods of early childhood as well as early elementary education (Ma, Shen, Krenn, Hu, & Yuan, 2016). The current circumstances of digital divide in terms of the access gap, usage gap, and literacy gap largely hurt disadvantaged families, and the lack of free quality science education resources impede parental involvement in young children's science education and should be addressed to align with the U.S. Department of Education's goal of providing greater equity and accessibility (2017).

In this report, I developed a technology-infused science education curriculum of 10 lesson plans for parents to guide their children's science learning and technology use at home. The report also potentially helps encourage and enhance the degree of involvement of parents in their children's education. Through a series of technology-infused science education lesson plans, parents are provided science education resources that incorporate the use of technology for young children and guidance for teaching children science learning at home using technology and the given resources. Parents also become exposed to a good variety of current cutting-edge technologies used for early childhood education and how each type of technology may be incorporated seamlessly into children’s daily learning especially for science. Through the series of hands-on, minds-on experience of using technology to teach children science, parents may start to appreciate the difference between active and passive screen time and to build strategies to help their children transform screen time into meaningful science learning time readily and easily.

Chapter 2: Literature Review

THE CURRENT DIGITAL DIVIDE IN THE U.S.

The digital divide has been defined as gaps at three levels: the access gap, the usage gap, and the literacy gap. Holland (2018) did a literature review about the digital divide in the U.S. and found that the gap in access to digital devices and internet is being reduced with collated efforts from all stakeholders including policymakers, schools, families, and communities, but it is still significant in terms of access to multiple devices or high-speed internet at home. A recent study shows that at least 15% of students in the U.S. have access to only one device at home amongst which 56% of these students have access to only a mobile device (Moore, Vitale, & Stawinoga, 2018). Pew Research Centre reported 24% of the residents in the rural area, 13% in the urban area and 9% in the suburban area in the U.S. have a major problem accessing to high-speed internet at home (Anderson, 2018).

The usage gap defined as the difference between active ways to transform learning and passive ways for information consumption using technology can be observed in the types of software, activities created for the learners, levels of software usage by teachers, and guidance from parents. Hohlfeld, Ritzhaupt, Dawson, and Wilson (2017) found that students from low socioeconomic status (SES) use software more for drill and practice or remedial work while high-SES students are using software more for higher-order activities such as creating or communicating. They also reported that more teachers in high-SES schools regularly use software for instructional purposes with students, families and the community (e.g., video conferencing, web publishing, and e-mailing families).

The digital literacy gap marked by differences in the skills and competencies required of the learners to read, write and make meaning using technology, between the affluent and the disadvantaged families has been shown to correlate to both the access gap

and usage gap (Holland, 2018; Huang et al., 2018). Huang et al. (2018) described the trend of low-SES parents placing more restrictions on their children's digital access and use of technology due to the parents' lack of digital literacy. When students and parents cannot access devices at home or have low access through only a smartphone or single device, then students may not develop basic digital literacy skills prior to entering school (CoSN, 2018).

Recognizing the different levels of the digital gap, the International Society for Technology in Education (ISTE) EdTech Conference 2018 highlighted many innovations and interventions to address the digital gap. For example, Consortium for School Networking (CoSN, 2018) developed 5-step strategies for school districts to address the connectivity gap which included:

1. Partner with community organizations to create "Homework Hotspots".
2. Promote low-cost broadband offerings.
3. Deploy mobile hotspot programs.
4. Install Wi-Fi on school buses.
5. Build private LTE networks.

Targeting the usage gap, educators shared their resources and best practices to create access and opportunities for all children every day. Examples presented include the Technology in Action Guides (Orth & Ott, 2018) that breaks down free resources into topics that fit every classroom and Tech for Tots (Fiscus & Ward, 2018) that shares resources and tips about technology integration for young children in the classrooms. Looking across the research field, there is increasing focus on the use of immersive or virtual environments to train preservice teachers and help preservice teachers refine pedagogical practices including the use of technology in the classrooms (Peterson-Ahmad, Pemberton, & Hovey, 2018). Immersive and virtual environments provide an authentic setting for preservice

teachers to practice the use of technological pedagogical content knowledge for more engaged learning in simulated classrooms which would in turn help to address the usage gap in the activities created for learners and levels of technology use by teachers. For the digital literacy gap among parents, there are many campaigns and organizations like the Singapore Media Literacy Council and MOE Cyber Awareness Resources trying to increase awareness for digital literacy and digital citizenship among parents. Parents and parenting groups such as Elizabeth Milovidov, Denise DeRosa, and Media Smart actively sharing resources about digital parenting can be found on Twitter, which may help increase awareness about digital literacy. However limited research has been done to understand the needs of parents with low digital access and how they could be supported to make use of existing digital resources to guide their children's use of technology and become confident digital mentors at home. Acknowledging the importance of closing the digital usage and literacy gaps for the disadvantaged families, the University of Texas at San Antonio (UTSA) has collaborated with school districts to provide monthly after-school technology workshops called La Clase Mágica (The Magical Class or LCM@UTSA) for families in need to increase the digital literacy and skills for parents. To find out the impact of such workshops for parents, a team of researchers led by Machado-Casas (2014) conducted a qualitative study with 12 of the participants attending the workshops. They conducted pre-surveys to understand the background and technology needs of the parents. During the 10 workshops, they used surveys and interviewed individual parents about how their digital literacy progressed and changed their ways of life. The results showed that these technology workshops helped the parents improve their digital literacy and better relate to their children. The parents also valued technology because they perceived it as a tool to help their children succeed in school. The researchers recommended their

technology workshop model used in the study for all other entities who aspire to collaborate and address digital equity issues.

The lesson plans developed in this report aim to help to guide parents with less digital skills and literacy to mentor their children's use of technology for learning more effectively at home. Parents may develop a clearer picture of how different types of technology may be integrated into teaching and learning in daily life to achieve different instructional purposes by going through the lesson activities with their children. The expected increase in digital skills and literacy of the parents after implementing the lesson plans will contribute to closing the digital usage and literacy gaps identified among parents.

THE LACK OF EARLY CHILDHOOD SCIENCE EDUCATION RESOURCES

The exposure to science literacy from a young age has been heavily emphasized by research (Moomaw, 2012). Kumtepe, Kaya, and Kumtepe (2009) used the Early Childhood Longitudinal Study-Kindergarten (ECLS-K) data to examine the effects of kindergarten experiences on children's elementary science achievement and discovered children who were more frequently involved in science activities in a richer science environment in kindergarten had higher levels of science achievement at third grade. In an attempt to understand the determinants of the frequency of science teaching in early childhood classrooms, Sackes (2014) conducted a quantitative study using the ECLS-K datasets and demonstrated that both the number of science method courses that teachers completed, and the availability of science-related instructional materials in kindergarten classrooms influence the frequency that teachers taught specific science concepts in kindergarten. In an editor's letter for the School Science and Mathematics (SSM) journal, Moomaw (2012) used rich research evidence to prove the importance of beginning science education early. However, she highlighted the severe lack of research and resources to prepare early

childhood teachers on science content and pedagogical knowledge. She urged science educators, early childhood educators, and researchers to form closer partnerships in order to capitalize on the learning potential of young children. If science education resources and preparation are scarce for early childhood educators, then it might be even harder for parents to access quality science education materials in order to be involved in their children's early science learning. Parental involvement from the early years has been proven by many research studies to have a high impact on children's school success in many areas (Hill & Taylor, 2004; Ma et al., 2016). The largest intervention program in the U.S., Head Start emphasizes the importance of parental involvement because it promotes positive academic experiences for children and is a critical feature of children's early academic development (Hill & Taylor, 2004). The lack of early childhood science education resources impedes parental involvement in children's early learning of science. The technology-infused science curriculum developed in this report centers around the content topics of science for kindergarten children and serves as an example of quality science education resources to help parents guide their children's early science learning at home at minimal cost through the use of technology.

THE NECESSITY OF TECHNOLOGY USE IN THE EARLY YEARS VERSUS SCREEN TIME CONCERNS

As early as the 1990s, Clements and Swaminathan (1995) concluded with evidence the appropriateness and benefits of introducing technology use to children in the early years. Later Clements conducted another study with Sarama (2005) and elaborated that we should focus more on what we should and should not do with technology for young children given the benefits of technology use children can experience in the social, emotional, and cognitive aspects. Frazel (2007) also stressed that time has shifted from

when people were skeptical about technology use in the early years to an era that technology use at home is a norm for young children who amazed educators by the speed at which they master technology concepts and use. Despite research evidence supporting the benefits of technology use from a young age, there is increasing debate surrounding the topic of screen time in the recent years amongst parents after the invasion of computers and technology into every home (Orben, Etchells, & Przybylski, 2018). Many parents are apprehensive about the extent to which screen time should be allowed for young children especially when these parents do not have much informed knowledge to confirm their beliefs either way. Clements and Sarama (2005) acknowledged such concerns in their studies and suggested the guideline of limiting screen time for children to 1-2 hours a day which is also the screen time limit for children aged between 2-5 recommended by the Australian government (Sweetser, Johnson, Ozdowska, & Wyeth, 2012). In Clements and Sarama's article, they also covered the following key points for educators and parents to bear in mind when using technology for an educational purpose:

- Technology should only be used when it helps children develop intellectually and socio-emotionally.
- Some applications of technology can be detrimental, for example, the use of technology to simply replace instruction and understanding or materials related to violence.
- It is necessary to have proper training and technology integration support amid all parties before the use of even high-quality technology can become meaningful.

In a related study intended to address concerns about screen time, Sweetser et al. (2012) found out that the majority of young children in Australia exceed the recommended daily screen time based on the dataset from the Australian Government's Longitudinal Study of Australian Children. With detailed investigations, they identified the need to

categorize screen time into active screen time versus passive screen time in order to more meaningfully examine the impact and effect of screen time on children. They defined active screen time as the time for screen-based activities that are cognitively or physically engaging such as using computers to do schoolwork, whereas passive screen time as screen-based activities that relate to passive receiving of information without cognitive or physical involvement. They cited many research findings to support the use of active screen time given its many potential positive effects on the development of children. In short, to allow or not to allow screen time for children, it depends on how it is used and guided appropriately. One of the key objectives of this report is to provide a set of comprehensive materials to help parents guide their children's technology use at home for content-rich learning and become confident digital mentors. Once parents know how technology can be used to effectively transform passive information consumption into active learning, concerns over screen time may reduce.

THE IMPACT OF AFTER-SCHOOL TECHNOLOGY USE

Research has shown significant impact of after-school technology use on the development and achievement of children in multiples areas. From 2003 to 2011, McPake, Plowman, and Stephen (2012) conducted a series of qualitative studies with 54 families to examine closely the effect of young children's technology use at home on their development. The researchers discovered noteworthy contributions by digital technologies on children's operational skills, learning about the world, dispositions to learn and understanding of the role of technology in life. They particularly highlighted the important role played by children's early technology experiences at home in their development of communicative and creative competencies. These competencies were immensely valuable for the children when they entered formal schooling and shaped their way of

communicating and expressing their ideas in creative ways. In a study related to the impact of after-school technology use in children's academic outcomes, Moon and Hofferth (2018) conducted a quantitative analysis of data from ECLS-K focusing on a sample of 2,139 immigrant families, and the results indicated that if children had access to a computer at home during the early elementary school years, they demonstrated increased mathematics test scores later. The positive impact of after-school technology use supported by research strengthens the relevance of this project because the curriculum materials have intentionally infused technology into each lesson plan and would allow children to use technology for learning at home after school under the guidance of their parents.

THE IMPORTANCE OF PARENTAL INVOLVEMENT IN CHILDREN'S EDUCATION

In a meta-analysis of the relationship between learning outcomes and parental involvement during early childhood education and early elementary education based on 46 studies, Ma et al. (2016) found a strong and positive correlation (.509) between learning outcomes in terms of academic achievement and parental involvement. They suggested that behavioral involvement, home supervision, and home-school connection were the keys of family involvement that promote learning outcomes. Examples of behavioral involvement can be visiting the school and participating in educational events. Home supervision refers to parents' effort to regulate activities at home after school such as monitoring homework and limiting television time. Home-school connection is established through a channel of communication whereby parents connect with the school to find out about their children's academic performance, school programs, and social behaviors. Digital parenting in this report falls under the category of home supervision which contributes significantly to children's academic outcomes. To examine how different types of self-efficacy (media competency, perceived parenting abilities, and perceived control

over parental mediation practices which refer to the ways parents can use to mediate the use of smartphones) influence the extent to which parents mediate their children's use of smartphones. Shin (2018) conducted a survey with 304 qualified participants and revealed that parents who felt confident about their own smartphone skills viewed themselves as good parents and believed that they had control over their parental mediation practices. Consequently, they were more likely to engage in parental mediation of children's smartphone use. Given the combined importance of technology use and parental involvement suggested by the literature, engaging parental mediation of children's technology use has become critical. This suggests the first step in making parents more involved in guiding their children's technology use at home is to support them with adequate education resources like the curriculum materials developed in this report and help them acquire the necessary digital literacy and skills to become confident mentors for the children.

THE 5E INQUIRY-BASED INSTRUCTIONAL MODEL

If the lesson plans developed are meant for parents to teach their children science at home, then incorporating an established instructional model for science in the design of the lesson activities to help parents successfully engage the children during the lessons is imperative. The 5E model of instruction has been proven to be one of the most effective for science education for many years across the world because of its ability to incorporate inquiry-based learning seamlessly. The development of the 5E model led by Bybee and Landes (1990) was based on contemporary research on student learning, educational psychology, constructivism and best practices for science education (Bybee, Taylor, Gardner, Scotter, Powell, Westbrook, & Landes, 2006; Duran & Duran, 2004). The model consists of five phases in the instructional cycle: Engagement, Exploration, Explanation,

Elaboration, and Evaluation (Bybee et al., 2006). During Engagement, the teacher uses short activities that promote curiosity and elicit prior knowledge to assess the learners' prior concepts and engage them in a new concept. Exploration consists of common base activities that allow the learners to use their prior knowledge and skills to generate new ideas or questions to enable conceptual change. Explanation allows the learners to show their conceptual understanding and skills about a particular aspect of their Engagement and Exploration experiences and deepen their understanding through the explanations provided by the teacher or the curriculum. Elaboration is when the teacher further increases the learners' understanding by facilitating additional activities. In the Evaluation phase, the teacher uses assessment strategies aligned with the learning objectives to evaluate the learners' development of concepts and skills. The model can be applied across different curriculum levels to organize daily instructional activities for science education (Duran & Duran, 2004). Bybee highlighted the flexibility of the model in various ways including the repetition of "E"s wherever necessary before advancing to the next phase or completion of the 5E cycle over a few lessons to form a coherent learning experience (Bybee, 1997; Duran & Duran, 2004). Many states across the U.S. today have integrated the 5E model as the core instructional and curriculum design strategy because of its effectiveness in fostering inquiry-based instructions (Duran & Duran, 2004; Scott et al., 2014). In a longitudinal study conducted to evaluate a 5th-grade science curriculum based on the 5E instructional model, the curriculum showed promise even for some groups of learners who have been traditionally less successful in science and STEM education as the percent change of science scale scores for the students, especially Hispanic students, using the curriculum was significantly higher than that of the other students not using the curriculum in Texas (Scott, Schroeder, Tolson, Huang, & Williams, 2014). In the early childhood sector, researcher Flannagan and kindergarten teacher Rockenbaugh (2010) in Virginia showed

firm belief in the affordance of the 5E model for guiding the design of science learning experiences in the early childhood classroom to create learning opportunities that allow one curiosity to lead to another for children. They worked together to develop science lesson units for kindergarten children using the 5E model and experienced tremendous success because the children demonstrated high level of curiosity throughout the lessons and generated many more questions even at home (Flannagan & Rockenbaugh, 2010). The success stories of the 5E model for science curriculum in early childhood education serve as the foundation for choosing the 5E model as the primary instructional model for the lesson plans developed in this report. Research-based evidence helps to assure the parents of the credibility of the work done for them.

TECHNOLOGY INTEGRATION FRAMEWORK & CURRICULUM DEVELOPMENT

Similar to why an appropriate science instructional model was needed to guide the design of the science instructional activities, a reliable technology integration framework would answer the question of how to effectively integrate each technology chosen for the lesson plans, especially when the rate at which technology evolves far exceeds the rate at which people become fully competent in using it. The Turn-around Technology Integration Pedagogy and Planning (TTIPP) model developed by Roblyer and Hughes (2019) provides a framework to help educators plan the integration of educational technology into their teaching effectively. The TTIPP model unpacks the technology integration process into three phases of 9 steps. Figure 1 shows the details of the model taken from the work of Roblyer and Hughes (2019):

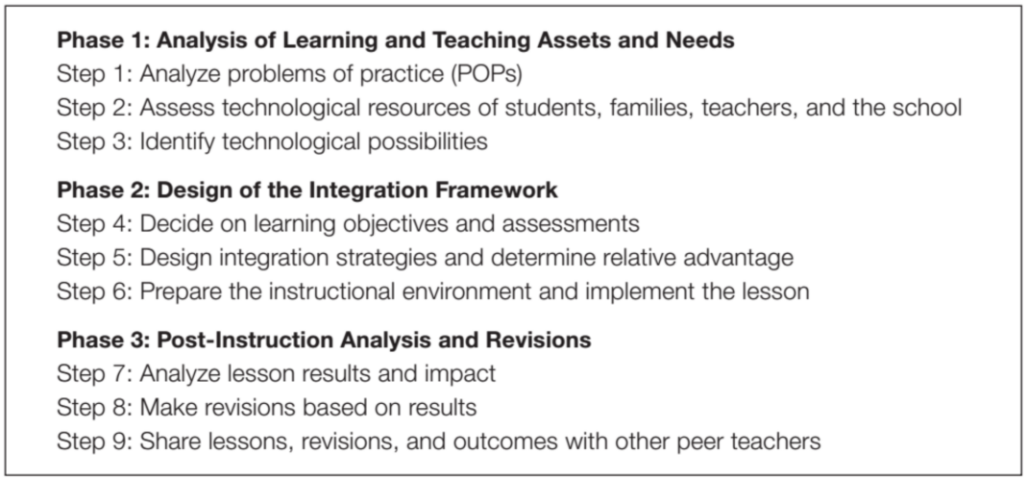


Figure 1: The Turn-around Technology Integration Pedagogy and Planning Model

With regards to the integration of technology for science instruction, Moore and Hughes (2019) affirmed the effectiveness of the 5E instructional model and suggested a variety of technology platforms to be integrated to facilitate inquiry-based learning cycle. Their examples include the use of virtual experiences (e.g., simulations, virtual reality, and field trips), content-rich resources (e.g., NASA and digital libraries), resources for science skills and learning (e.g., Scratch and G Suite), and websites allowing access to scientific information (e.g., NASA and NIH).

In this report, I have leveraged the TTIPP framework and strategies for science instruction provided by Roblyer and Hughes (2019) to develop the technology-infused science education curriculum for parents. Each of the 10 lesson plans started with some problems of practice in terms of digital literacy for parents and science content mastery for young children in mind. After assessing the technological resources of the families, a key technology was identified to address the problems of practice. Subsequently learning objectives were defined and assessment strategies were created to align with the learning objectives. In step 5 of the TTIPP model, what stands consistent throughout all the lesson plans would be the grouping of pair work (the parent pairing with the child) and the

integration of the 5E model to guide the instructional sequence and activities to facilitate inquiry-based learning. The relative advantage of each technology chosen was carefully considered. The instructional environment has been assumed based on what most families including the disadvantaged ones could afford, and testing of the lessons was conducted with children from my immediate family to help predict potential issues during implementation. The three steps of Phase 3 of the TTIPP model can be implemented after observing parents conduct the lessons and/or getting feedback from the parents for revision, which is not within the scope of this report. The curriculum materials developed in this report to help parents guide their children's science learning using technology potentially address the gaps identified and discussed across the literature review section. The curriculum materials help to close the digital gap by allowing parents to gain digital skills and literacy, tackle the lack of quality science education materials for parents in the early childhood sector and encourage active parental involvement in children's early science learning experiences. The reliability of the lesson plans in achieving the aforementioned goals rests upon the use of research-supported instructional model and technology integration framework discussed earlier.

Having been a K-12 science educator for the past 10 years, I have had the privilege of witnessing the powerful impact of integrating the 5E model and technology on student learning. Nevertheless, a lesson plan can only serve as a suggested guide for those people conducting the lesson and should be modified wherever deemed necessary based on the actual context of the learner ability and learning environment. I hope that this curriculum will serve as an example to encourage a community-level effort to engage and support parents in areas of professional development pertaining to their involvement in children's education and technology use, which is critical for children's success in life.

Chapter 3: The Curriculum

INTRODUCTION TO PARENTS

As technology advances and becomes an inseparable part of children's daily life, parents worry about the amount of screen time and the type of activities children engage in (Orben, Etchells & Przybylski, 2018). Parents may desire more knowledge about guiding their young children's technology use for active learning at home. Many research studies suggest the importance of parental involvement in children's education from an early stage for the success of the children in school life later (Hill & Taylor, 2004; Ma et al., 2016). Parental involvement can mean being a digital mentor for the children at home or learning a particular subject content with the children, amongst many other forms of involvement. Science is a subject area in which children can benefit tremendously through early exposure and learning experiences both at school and at home (Kumtepe, Kaya & Kumtepe, 2009; Sackes, 2014). Unfortunately, the current lack of free quality science education resources for early childhood (Moomaw, 2012) impede the involvement of parents in their children's early science learning experiences. To address the issues and concerns related to parents mentioned above, a technology-infused science curriculum package has been developed in my master's final project with the Learning Technologies Program in The University of Texas at Austin to help parents guide their children's science learning at home through the use of technology, and become more confident digital mentors for their children.

The curriculum developed in my project consists of 10 lesson plans aligned with the Next Generation Science Standards for kindergarten science. All lesson plans were designed using the well-established 5E (Engagement, Exploration, Explanation, Elaboration, and Evaluation) (Bybee & Landes, 1990) instructional model for science to guide the planning of lesson activities. The 5E model comprises five phases of instruction

and the activities created for each phase are aligned with the overall objective of the corresponding phase. For example, during the Engagement phase, short activities that promote curiosity and elicit prior knowledge are used to assess the learners' prior concepts and engage them in a new concept. A research-based technology integration framework Turn-around Technology Integration Pedagogy and Planning (TTIPP) model provided by Roblyer and Hughes (2019) was used to ensure the effective integration and relevance of each technology used in the lessons.

In each of the lesson plans, there is information about some common problems related to digital skills or science learning, the choice of the technology and the topic of science addressing the common problems targeted, duration of the lesson, technology tutorials, learning objectives, materials needed, instructional activities guided by the 5E instructional model as well as the NGSS aligned. To allow easy access to the curriculum package for all parents, this web page was created to host the materials (https://mayingclasses.wixsite.com/kiddyscience/technology-for-science). Parents are highly encouraged to implement the lessons at home with their kindergarten children and provide feedback about the effectiveness of the lesson plans or any issues faced by commenting beside each lesson plan on the website. Should there be further technical support required and not covered by the list of technology tutorial resources provided below, parents are most welcome to send an email to yingma@utexas.edu for more assistance.

ANSWERS FOR QUESTIONS IN EACH LESSON

Questioning is frequently used in each lesson plan to probe children's thinking and elicit ideas. Parents can find the suggested answer to each question right after the question itself placed within a parenthesis starting with R which means Response to the questions.

Italicized comments are notes meant for parents to just pay attention to when conducting the activities with the learner. One example of a question, comment and response are shown below:

- Where is the Sun at night? *Allow the learner to think for at least 10 seconds.* (R: It is still there, but we are not able to see it.)

LIST OF TECHNOLOGY TUTORIALS

Following is the list of tutorials curated to help the parents familiarize themselves with the different types of technology used in the lesson plans:

- How to download and install apps for PC: https://youtu.be/9zBrBcI72lM
- How to download and install apps for Mac: https://youtu.be/ETpPJQtjS4c
- How to download apps on Android phones: https://youtu.be/3ersoPfhTXE
- How to download apps on an iPhone: https://youtu.be/IYZzxpFMytg
- Tux Paint tutorial: https://youtu.be/O6hKk-0dzKA
- AR Cake Baker tutorial: https://youtu.be/vCjyAp-XItU
- PhET Circuit Construction Kit tutorial: https://youtu.be/dALtroXmNIQ
- My Storybook tutorial: https://youtu.be/shnIaMDFZUk
- ScratchJr tutorial: https://youtu.be/ciWPaEgscr0

SCIENCE TOPICS

Following is the list of science topics covered in the curriculum package:

- The Solar System
- Seasons / Weather
- World Geography
- Food Science

- Bees and Honey Production
- Days and Dates
- Electricity
- Hydration
- The Parts of a Plant
- Engineering Design

TYPES OF TECHNOLOGY

The types of educational technology below are introduced and integrated into the curriculum package:

- YouTube Videos
- Digital Library
- Digital Drawing Tool
- Augmented Reality
- Virtual Reality
- Online Game
- Online Simulation
- Digital Newsroom for children
- Digital Story-Making Tool
- Coding for children

LESSON PLANS

The following tables starting from the next page present the 10 lesson plans designed for this curriculum package:

Table 1: Lesson Plan 1

Lesson 1 Topic: Learning about the Solar System using YouTube videos
Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten
Introduction: Problems to be Addressed 1. Digital Literacy: One of the main digital learning challenges today is the fact that young children are engaged in lots of screen time and many parents worry about the negative impacts of screen time due to the lack of knowledge about digital mentoring. 2. Science Learning: A commonly identified idea hard to visualize for young children is the fact that our Sun is much larger than the Earth. To address the two challenges surfaced above, I examined the types of technology commonly available to most families and found through studies that most children today love YouTube which is easily reachable using any device with internet access. Children love YouTube because they enjoy the feeling of being able to learn something of their interests independently at their own pace and comfort. There is also a great variety of science education resources on YouTube related to the Solar System. Therefore, YouTube was chosen for this lesson and the video selected allows children to visualize the abstract idea of the sizes of all the planets relative to the Sun in the video. Since many states recommend screen time limit of 1 hour per day for children less than 8 years old, I suggest parents set the screen time at 45-60 minutes including accompanying activities when you let them watch YouTube. In this lesson, I would like

Table 1 (continued)

to show all parents a simple example of using YouTube video to learn about the Solar System with young children. Once parents are comfortable conducting learning activities with YouTube, they will see how passive screen time can be transformed into active learning time with parental guidance.

Quick Facts About the Solar System

- The solar system includes the Sun which is a star and all the planets, comets, asteroids, meteoroids and moons orbiting around it.
- The eight planets in the Solar System are Mercury, Venus, Earth and Mars, Jupiter, Saturn, Uranus, and Neptune. Mercury is the nearest while Neptune is the farthest from the Sun.
- Mercury, Venus, Earth, and Mars are smaller and mainly made of rock and metal. The other planets farther away are much larger and mainly made of gases.
- If you wish for more information:

  https://theplanets.org/solar-system/

  https://youtu.be/Myfr5u_xClQ

Required Materials:

- Computer / smartphone / tablet with internet access
- Drawing materials (paper, pencils, crayons, etc.)
- Solar System Activity Sheet

Table 1 (continued)

Lesson Learning Objective(s):

- Observe, describe and illustrate objects in the sky such as the clouds, planets, and stars including the Sun.
- Discuss the existence of day and night as a result of the Earth spinning while revolving around the Sun.
- Identify the differences amongst the planets in terms of their sizes, colors, relative positions to each other and distances from the Sun by matching and coloring the correct planets.

ENGAGEMENT (5 min)

Driving Question: Have you ever wondered why there are days and nights in this world?

- Ask the learner:
  1. Why is it bright in the daytime and so dark at night? (R: There is sunlight in the daytime.)
  2. Where is the Sun at night? *Allow the learner to think for at least 10 seconds.* (R: It is still there, but we are not able to see it.)
- Tell the learner that we will watch a science YouTube video to find out the answers today and will also explore the Solar System.

EXPLORATION (5 min)

Driving Questions: Why are there days and nights? What else are there in our Solar System?

Table 1 (continued)

- Play the Solar System video and pause at 1:22 (1 min and 22 seconds): https://youtu.be/FDTx9ZH2SpM

EXPLANATION (10 min)

Driving Questions: Why are there days and nights? What else are there in our Solar System?

- Ask the learner:
  1. What causes days and nights that we experience? *Allow the learner to think for at least 10 seconds.* (R: The Earth is spinning and moving around the Sun, so we have sunlight and daytime when facing the Sun, and have no sunlight and nighttime when back-facing the Sun.)
  2. Is the Earth the only planet moving around the Sun? (R: No.)
- Tell the learner that we will find out in the next part of the video.

ELABORATION (15 min)

Driving Question: What else exists in our Solar System?

- Play the Solar System video from 1:36 and stop at 2:17.
- Move the video to time 1:55 and pause there to show the name of each planet.
- Recall the name of each planet with the learner.
- Ask the learner:
  1. Which planet is the biggest (R: Jupiter.)? And the smallest (R: Mercury.)?
  2. Which planet is the nearest to the Sun (R: Mercury.)? And the farthest (R: Neptune.)?

Table 1 (continued)

3. Which planet is your favorite? Why? *Allow the learner to talk about the colors or any reasons they state.*

- Play the Solar System Song to the learner.

EVALUATION (10 min)

- The Solar System Activity Sheet shows a picture of the Sun and its planets in order. Let the learner draw lines to match the names to the correct planets.
- Ask the learner to color each of the planets based on what has been learned. Show the picture on the screen if the learner needs a recap.
- Let the learner draw his/her favorite planet on a new sheet of drawing paper and color it. Ask why it is the favorite planet.

CLOSURE

Now that the learner is familiar with the Solar System, you may allow him/her to play the Solar System Song a few more times and learn to sing it. You will be surprised by how much the learner remembers the next time you recap.

NGSS Alignment:

K-PS3-1: https://www.nextgenscience.org/pe/k-ps3-1-energy

K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design

K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design

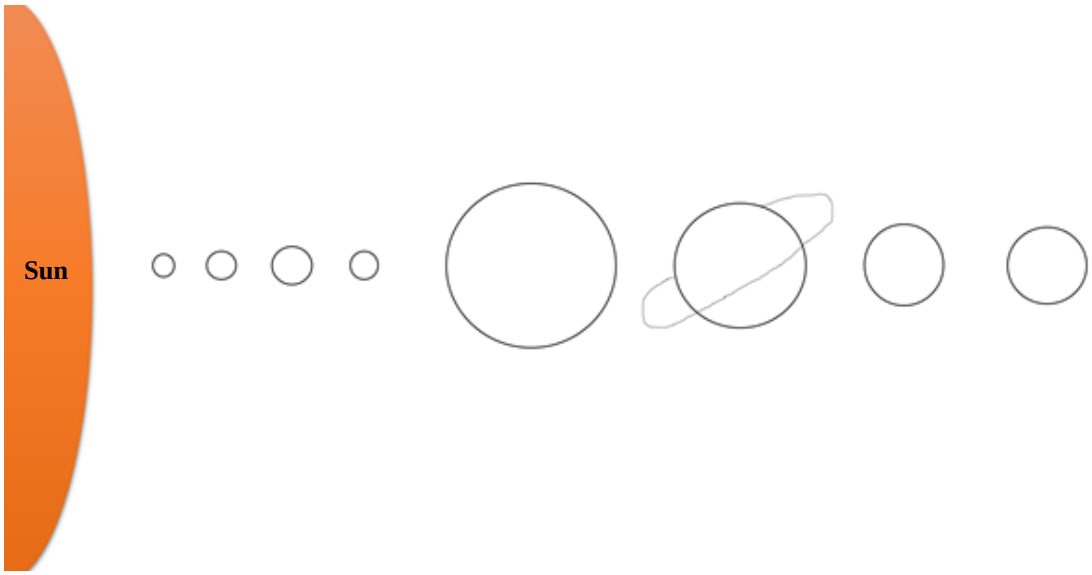
1-ESS1-1: https://www.nextgenscience.org/pe/1-ess1-1-earths-place-universe

Solar System Activity Sheet

Name _____ Date _____

Activity 1: Do you remember the names of the planets in our solar system? Match the names to the planets illustrated below.

Venus Mars Earth Saturn Neptune Uranus Mercury Jupiter



Activity 2: Color the planets in the picture above, based on what you remember about the planets.

Table 2: Lesson Plan 2

Lesson 2 Topic: Revising the Solar System using Digital Drawing Tool - Tux Paint

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: One frequently asked question by parents is what types of technology to choose for young children since there are so many available out there which can be overwhelming.
2. Science Learning: Many types of activities can engage children in learning, but getting them to retain the science knowledge learned is a challenge.

Which types of technology to choose depend on various factors: What purpose is it intended for and does the technology have the features needed? What technology is affordable and available to the parents and children? How is the public rating for the technology (e.g., How many stars rated in the app store?) In this lesson, we hope to find a technology that helps children retain science concepts and one of the highly recommended ways is getting children to draw because drawing according to research helps with memory retention better than writing (https://www.sciencedaily.com/releases/2018/12/181206114724.htm). Furthermore, the majority of young children enjoy drawing as it allows them the room for imagination and expressing their feelings. There are many digital drawing tools available, but one that is free for all, easily accessible and widely used by kindergarten educators is Tux

Table 2 (continued)

Paint. Tux Paint is a free app allowing children to draw and demonstrate their creativity using the computer. Using technology for drawing does not only allow the children to make multiple attempts without wasting paper, but it also helps both parents and children appreciate technology tools as a means for meaningful learning and engagement. Tux Paint is very intuitive and easy to use. The Tux Paint tutorial shows most of its key features: https://youtu.be/O6hKk-0dzKA
Materials: • Computer with internet access • Picture of the Solar System • Tux Paint software: www.tuxpaint.org
Lesson 2 Learning Objective(s): • Demonstrate digital creative drawing skills. • Create a digital representation of a favorite planet. • Draw a digital representation of the Solar System.
ENGAGEMENT (5 min) • Present a picture of the Solar System: https://en.wikipedia.org/wiki/Solar_System#/media/File:Planets2013.svg • Ask the learner: 1. Which is your favorite planet of the Solar System learned before? *Allow the learner some time to recall.*

Table 2 (continued)

2. What other planets do you still remember about our solar system? *Recall as many facts as possible based on the given picture.*
3. Would you like to draw the whole solar system today using the computer and make it as perfect as you wish? *Sound exciting to intrigue the learner.*

EXPLORATION & EXPLANATION (20 min)

Driving Question: How to draw digital representations?

- Tell the learner that we need to watch a short YouTube video together on a computer drawing tool called Tux Paint first to learn how to use it.
- Play the Tux Paint tutorial https://youtu.be/O6hKk-0dzKA
- Open Tux Paint on the computer and teach the learner the following steps one by one allowing him/her the main control of the mouse.
- Tutorial Steps for this lesson purpose:
  1. Click "New" and select a preferred background.
  2. Click "Shape" and move the cursor to the right menu column and use up-down arrows to browse more shapes.
  3. Click a preferred shape and drag it to the preferred location on the canvas
  4. Allow the learner to add more shapes.
  5. Click "Paint" and do a random drawing on the canvas, then select a different brush on the right column to draw again.
  6. Click "ABC Text" and select a preferred font type on the right column, then type some text on the canvas.

Table 2 (continued)

7. Click “Stamp”, “Lines” and “Magic” to allow the learner to explore more options.
8. Click “Eraser” to remove any unwanted parts on the canvas.
9. Click “Save” to save the artwork.

- Explain to the learner that drawing about something learned before helps to remember the knowledge even better than writing notes and Tux Paint can be used to do the drawing whenever needed without wasting drawing materials.

ELABORATION (10 min)

Driving Question: How can we create the digital representation of your favorite planet using Tux Paint?

- Allow the learner to refer to the picture of the Solar System.
- Let the learner use Tux Paint to recreate the drawing of the favorite planet.

EVALUATION (10 min)

Driving Question: Can you draw the solar system based on what you remember?

- Praise the learner for being able to master Tux Paint now.
- Emphasize that digital tools like this can help to save paper and allow one to remember knowledge better.
- Challenge the learner to create a drawing of the solar system using Tux Paint, offering him/her guidance along the way by helping to recall key facts.
- Allow the learner to verbally share about the digital creation which evaluates how well he/she remembers the facts after drawing.

Table 2 (continued)

CLOSURE ● Tell the learner that you are very proud of the creative work and encourage the learner to use Tux Paint in future when he or she would love to practice more on drawing or try to remember things better.
NGSS Aligned: K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design 1-ESS1-1: https://www.nextgenscience.org/pe/1-ess1-1-earths-place-universe

Table 3: Lesson Plan 3

Lesson 3 Topic: Learning about Nature/Geography using Digital Library - Storyline Online and Google Map

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: With millions of free digital books and media available online, parents wonder which ones are reliable and age-appropriate for young children.
2. Science Learning: Many young children have difficulty visualizing the world comprising of huge continents, and things of nature (weather, sceneries, etc.) vary across different parts of the world.

The amount of free digital books and media online is indeed overwhelming, so the key to address this is to find the ones recommended by credible sources or with excellent reviews from the users. Parents should then try out the resources to examine the relevance before confirming the content and age-appropriateness. Storyline Online (https://www.storylineonline.net/about-us/) is an award-winning children's literacy website that provides videos of actors reading children's books aloud in engaging ways. Reading aloud to children has many benefits including helping them with comprehension, writing, speaking and communication skills. Everything is free for access without the need to sign in or register for membership. Google Map provides real-time imagery pictures of any location in the world with a variety of views and can

Table 3 (continued)

help children to visualize the continents of the world from different perspectives. This lesson introduces parents to one of the books called *How I Learned Geography* from Storyline Online to illustrate how children may learn about nature through a digital storybook and interactive Google Map with parental guidance.
Materials: ● Computer / smartphone / tablet with internet access ● Storyline Online: https://www.storylineonline.net/about-us/ ● Google Map: https://www.google.com/maps
Learning Objective(s): ● Observe and describe the change in weather/natural sceneries associated with changes in locations. ● Express empathy for the boy's situation and appreciation of the joy that reading/learning can bring about in life. ● Locate the countries the author had to travel through and trace his journey on Google Map. ● Locate the main continents of the world on Google Map.
ENGAGEMENT (10 min) ● Tell the learner: 1. I know you love listening to stories. Would you like to listen to a really cool story today about the world? 2. Today I have got a great helper to read to us! It is a digital library called

Table 3 (continued)

Storyline Online. I will enjoy the story together with you, but you will need to listen very carefully so that we can both talk about it after that. We just need to go online using the computer and choose a book called *How I Learned Geography*. • Show the learner how you access the digital library Storyline Online and play the story: https://www.storylineonline.net/books/how-i-learned-geography/
EXPLORATION (5 min) Driving Question: What is the story mainly about? • Ask the learner to summarize the main story. *Offer hints to help him/her express the understanding when stuck.* (R: The story is about a boy and his family that fled to a strange country because of war. The family live in poverty and hardly have any food to eat. When the boy's father brings home a map instead of bread for supper, the boy is disappointed because he is so hungry. However after his father hangs the map on the wall, the boy studies the map in detail and travels to exotic places around the world within his room. He has so much fun and realizes that the map feeds him joy that bread could never do.)

Table 3 (continued)

EXPLANATION (10 min)

Driving Question: What changes does the boy experience when traveling around the world?

- Ask the learner:
  1. *"There was burning deserts."* What's the weather like in the deserts? (R: Hot.) Which season is that? (R: Summer.)
  2. What's the weather like on snowy mountains? (R: Icy wind, very cold.) Which season is normally cold? (R: Winter.)
  3. What are the other seasons of a year? (R: Spring, Fall.) *Talk about the weather too.*
  4. What does he see in fruit groves? (R: Papayas and mangos.)
  5. What kind of buildings does he see in cities? (R: Tall buildings with many windows.)
  6. Is the boy happy after all? What makes you think so? (R: Yes. Reading or learning about new things can make us happy.)

ELABORATION (10 min)

The author Uri Shulevitz was born in Poland and wrote this story based on his early life experience. His family fled to Kazakhstan because of war. Much later they traveled to France for two years and then moved to Israel. After spending 10 years there, they finally arrived in the United States in 1959.

- Share the author's story with the learner.
- Ask the learner to recall the countries the author lived before and note the names.

Table 3 (continued)

- Ask the learner:
  1. Do you know where those countries are on the map?
  2. Do you know how far those places are from each other?
- Tell the learner that we can easily find out using Google Map using on any smart device or computer.
- Open Google Map on the computer/tablet/mobile and show the child how to find a country (e.g., United States) on the map.

EVALUATION (10 min)

- Ask the learner to locate all the countries that the author lived before on the map.
- Pointing to the map, highlight the name of each continent correspondingly to the child and introduce all the seven continents.

CLOSURE

Ask the learner if he/she would like to learn more about the continents and search on the digital library for more related digital books.

NGSS Aligned:

K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design

K-ESS2-1: https://www.nextgenscience.org/pe/k-ess2-1-earths-systems

K-ESS2-2: https://www.nextgenscience.org/pe/k-ess2-2-earths-systems

K-ESS3-1: https://www.nextgenscience.org/pe/k-ess3-1-earth-and-human-activity

Table 4: Lesson Plan 4

Lesson 4 Topic: Learning about Food Science using Augmented Reality - AR Cake Baker

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: Many parents have heard of AR (Augmented Reality) technology, but the term sounds alien to them in the educational context.
2. Science Learning: One effective way to engage children in the learning of food science is to allow them to experience the making of food, but it is often too costly in terms of material supplies and physical manageability to let young children do the actual cooking.

AR stands for augmented reality which is a technology that infuses digital elements into a live view (like what Pokemon Go does) to allow more authentic experiences. AR has many benefits for learning (https://www.virtualiteach.com/single-post/2017/11/24/Why-AR-8-reasons-to-use-augmented-reality-in-education) including allowing children to experience objects that would not be possible in reality, making learning interactive, having multiple dimensional views, stimulating the senses of the learners, etc. In this context, AR fits the needs of letting children experience the actual process of making food when learning food science. Lesson 4 introduces parents a very popular and highly rated AR Cake Baker app (Android and iOS) to help children learn

Table 4 (continued)

some food science. The app is free for download and use, but you may upgrade it to unlock more features. AR Cake Baker (Tutorial: https://youtu.be/vCjyAp-XItU) allows children to mix the ingredients for a cake chosen and go through the whole process of making and decorating the cake virtually. The children may learn about food science and at the same time develop their creative and hands-on skills. Parents would get to appreciate an example of how AR technology may be integrated with science learning for young children.

Common Ingredients for Making a Cake

- Flour / Cake Mix
- Milk
- Eggs
- Oil/Butter
- Water

Materials:

- Smartphone (Android or iOS) with internet access
- AR Cake Baker Android: https://apktada.com/app/com.vrlittles.ARCakeBaker
- AR Cake Baker iOS: http://bit.ly/ARCakeBaker-iOS

Learning Objective(s):

- Describe the general ingredients used to make a cake by naming some of them.
- Complete the tutorial steps to bake a cake and take a picture of the final product with the learner inside.

Table 4 (continued)

- Reproduce the general steps involved in baking a cake by selecting a different cake in the AR Cake Baker app and completing it by him/herself.

ENGAGEMENT (10 min)

- Ask the learner
  1. Which of your friends' birthday is coming up next? *Let the learner think for a while and respond.*
  2. Would you like to make a cake for your friend to surprise him/her? (R: Yes!)
  3. Before we start, can you tell me what are some of the ingredients/things we need to make a cake? *Offer some hints like suggesting the taste or texture to allow the learner to associate with possible ingredients.* (R: Flour, milk, eggs, oil/butter, water, sugar, etc.)

EXPLORATION (10 min)

Driving Question: How do we make a cake?

- Tell the learner that there are some steps involved before we can bake a cake and we will use an app called AR Cake Baker to learn about it today.
- Show the app on the phone to the learner and guide him/her following the tutorial steps.
- Tutorial Steps:
  1. Select a cake by tapping it and dragging it onto the pink dotted circle area.
  2. Start mixing the ingredients: Tap the flour and drag to the bowl; Tap the milk and drag to the bowl; Do the same for the rest of the ingredients on the

Table 4 (continued)

screen. 3. Tap the mixer and turn it around the bowl to mix all the ingredients. 4. Tap "Bake" and select either the conventional oven or microwave oven to start baking the cake. 5. The timer would appear and when it is done, start decorating the cake by choosing the outlook, the cake-stand, whip cream, candle, lollipop, etc. 6. When finished decorating, tap the camera icon and take a picture of the learner with the cake by placing the phone in front of the learner.
EXPLANATION (5 min) ● Explain to the learner that cooking always involves a list of ingredients and steps to cook it after getting prepared. ● Highlight that different kinds of food require different types of ingredients, equipment or steps to make it.
ELABORATION (10 min) ● Ask the learner: 1. Why do we need different kinds of food instead of eating only the ones we love such as cakes every day? (R: Our body needs different kinds of nutrition to support its functioning. Bones need calcium in milk to grow, blood needs iron in meat, the body needs energy from grains, etc.) 2. What are the general steps we went through to make the cake? (R: 1. Prepare the ingredients; 2. Mix the ingredients; 3. Bake it using an oven with a timer;

Table 4 (continued)

4. Decorate the cake)
EVALUATION (10 min) • Ask the learner to choose another cake from the AR Cake Baker app and bake the cake independently. • Help the learner send a picture of the cake to his/her friend by message/email if possible. **CLOSURE** Tell the learner that we can bake a real cake next time to check if AR Cake Baker did a great job in preparing us. The link here provides many recipes about making a cake: https://iambaker.net/category/i-am-baker/cakes/
NGSS Aligned: K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design K-2-ETS1-3: https://www.nextgenscience.org/pe/k-2-ets1-3-engineering-design

Table 5: Lesson Plan 5

Lesson 5 Topic: Learning about Bees using Virtual Reality - Google Expeditions

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: VR (Virtual Reality) is a technology most parents might have heard of but intimidating because many VR headsets are relatively expensive and not as easy to use for parents.
2. Science Learning: Learning about animals like bees is interesting to children, but it is sometimes impossible for learners to examine the animals or look at their living environments closely in reality.

VR stands for virtual reality and is a type of immersive technology that uses computer-generated simulation of objects or the environment to allow the user experience and interact with the virtual world in a seemingly real way. Many users turn away from VR because they assume it always requires a VR headset which is costly and technical knowledge about how to use the headset. However, as technology advances, there are now many free VR resources available for educational purposes which require no headset. With the help of such resources, children get to virtually experience many things (e.g., examining the body parts of animals) that they might not have the chance to do in reality. Google Expeditions (https://tinyurl.com/jfeetck) is an immersive application demonstrating VR technology with over thousands of virtual tours. In

Table 5 (continued)

Lesson 5, children learn about one of the most important animals in the world, bees! Many plants on our planet rely on bees to reproduce and humans depend very much on crops produced by plants to survive. Furthermore, children generally love honey and they may easily relate the knowledge learned today to what they see or use in daily life. At the end of the lesson, parents get to have a glimpse of how free VR resources like Google Expedition may enrich children's learning by allowing them to look closely at the body parts of bees and their living environment.

Quick Facts About Bees

- Bees have been around for at least 100 million years.
- The main parts of a bee's body include compound eyes that can see ultraviolet light, stinger for defense, poison sac where its venom is produced, honey stomach where honey is made.
- Since bees can see UV light, flowers use UV light to make the nectar and pollens obvious to attract bees.
- All honey bees work together to protect the hive. They have 3 roles: workers that are all females and the main workers for the hive, drones for mating, the queen which is the only reproducing member of the hive.
- Some working bees collect the nectar from flowers and turn it into honey by first storing it in the honey stomach and regurgitating it into the mouth of a honey-making bee back at the hive. The honey making bee repeats the process to make the honey concentrated. Finally, the honey would be stored within a honeycomb cell where beekeepers can collect them.
- Bees also collect pollen to feed their young and help to cross-pollinate for plants

Table 5 (continued)

in this process. ● The population of bees is decreasing mainly due to the impact of pesticides, so one way to protect them is by creating pesticide-free environments for them. Facts are from Google Expedition Tour: https://poly.google.com/view/7t5RHimmJ7P
Materials: ● Smartphone (Android or iOS) / Computer with internet access ● Google Expedition for Android: https://play.google.com/store/apps/details?id=com.google.vr.expeditions ● Google Expedition for iOS: https://itunes.apple.com/us/app/id1131711060?uo=4&at=10laCG&ct=website ● Access https://poly.google.com/view/7t5RHimmJ7P if using computer ● Drawing materials (paper, pencils, crayons, etc.)
Learning Objective(s): ● State the main parts of a bee's body. ● Categorize the roles of honey bees by relating to their functions correspondingly. ● Draw a picture to illustrate the general steps of the honey making process by bees.
ENGAGEMENT (10 min) ● Ask the learner 1. Are you afraid of bees? (R: Yes, because they sting.)

Table 5 (continued)

2. Yes. Bees may sting, but they do it only to protect themselves. Do you know that bees are very important for plants and for us? (R: Bees help plants reproduce and we rely on many plants for survival. Bees make honey for our daily use.) 3. Would you like to look closely at how bees produce honey? (R: Yes!)
EXPLORATION (5 min) ● Tell the learner that we will use a VR app called Google Expedition today to look closely at how bees work. ● Show the app on the phone to the learner and search for "Bees and Honey Production" to save it. If a computer is used, just access the tour here: https://poly.google.com/view/7t5RHimmJ7P ● Let the learner scroll the screen around to see the 3D environment and what to expect. ● Touch the horizontal white bars at the bottom of the screen to read the text for explanations. When scrolled down, there are some options that when selected would display the corresponding parts on the screen. ● Touch the top of the white bar again to close the text and look at the screen.
EXPLANATION (10 min) Driving Question: How do bees make honey? ● Tell the learner that before we find out how bees make honey, we need to look at how their body parts help them work.

Table 5 (continued)

- Tap the “Anatomy of a Bee” bar:
    1. Scroll down and select “Stinger” and close the text bar to look at the stinger on the picture. Ask: What does the stinger do? (R: Bees use the stinger to sting and protect themselves.)
    2. Do the same for “Compound eyes”, “Poison Sac” and “Honey Stomach”. Refer to the quick facts given above for the key functions of these parts if needed when explaining.
- Scroll the white bar to the left to see more text bars.
- Tap the “Hive Life” bar:
    1. Ask: How do bees work together? (R: They have different roles: the queen bee is the only reproducing member of the hive, the worker bees that are females and look after the hive and the other bees, the drones are males just for mating.)
    2. Select each role on the text bar and let the learner look at the picture to see where they are around the hive.
- Tap “Collecting Nectar” bar:
    1. Ask: So how is honey made? (R: Bees collect the nectar from flowers and store it in their honey stomach. They regurgitate it to the mouth of worker bees at the hive and the process goes on till the honey is thick enough.)
    2. Select “Collecting Nectar” to show the learner.
    3. Ask: Why do bees collect pollen also? (R: Bees use pollen to feed their baby bees too. When collecting it, some pollen is passed between the male and female flowers so that the plants can reproduce.)

Table 5 (continued)

4. Select “Collecting Pollen” to show the learner.
ELABORATION (10 min) ● Tap the “Making Honey” bar: 1. Say: What does the honey making process look like? Let’s discover it! 2. Select the 4 steps (Arriving Workers, Distilling Nectar, Storing Honey and Collecting Honey) one by one and let the learner visualize the whole process. *Explain briefly what each step is about by referring to the text given.* ● Tap the last two text bars to mention about the importance of bees and providing pesticide-free environments to protect them.
EVALUATION (10 min) ● Show a picture of a bee’s body (e.g., http://www.thoughtrot.com/wp-content/uploads/2017/08/bees.bmp) and ask the learner to state the parts and their functions. ● Ask the learner to recall the process of honey making and draw a picture for it. **CLOSURE** Tell the learner that we now know the importance of bees and should try our best to protect them in the future.
NGSS Aligned: K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design

Table 5 (continued)

K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design K-LS1-1: https://www.nextgenscience.org/pe/k-ls1-1-molecules-organisms-structures-and-processes K-ESS2-2: https://www.nextgenscience.org/pe/k-ess2-2-earths-systems

Table 6: Lesson Plan 6

Lesson 6 Topic: Learning about Days and Dates using Online Games - Starfall

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: Parents often cannot relate online games to educational purposes but associate them with negative outcomes such as addiction.
2. Science Learning: Young children generally find it hard to tell the difference between days and dates when first introduced.

There are millions of online games available for children nowadays. If children are left to choose or play the games on their own, there can be many detrimental effects such as accessing inappropriate content and spending an extensive amount of time on the game. However, if parents can identify the games recommended by professionals and guide the children to play purposefully for learning, then online games can be powerful tools to engage the young learners in learning. Starfall.com is a popular and highly rated website by K-12 teachers across the U.S. and it provides free interactive games/simulations to enrich children's learning experience. You may find many free apps on the website for different topics/subjects and let the children play whenever there is an internet connection. If you prefer using a mobile phone to access Starfall, you may also find it in both Android and iOS stores. One of the games Calendar on Starfall allows children to visualize the days of the week and dates of the month on an

Table 6 (continued)

interactive calendar and better appreciate the difference between days and dates by clicking to answer the guiding questions. There is audio embedded to help children along with the game. Planning is one of the critical skills our children need in order to succeed in life. After playing the game with the children, parents may begin to relate online games to more meaningful uses when parental guidance is provided and children learn planning skills by using the calendar to plan some events or activities.
Materials: ● Computer with internet access/smartphone (Android or iOS) ● Calendar game: https://www.starfall.com/h/holiday/calendar/?sn=main
Learning Objective(s): ● Identify the correct day and date of a given day on the calendar. ● Plan some activities for a week on an empty calendar and follow the plan accordingly.
ENGAGEMENT (5 min) ● Ask the learner 1. What are we doing next weekend? *Allow the learner time to talk about some things he/she hopes to do and try to plan those things for the next week if possible.* 2. Shall we plan something together for our family to do together next week? ● Tell the learner that it is important to make a planner on the calendar so that everybody can remember it.

Table 6 (continued)

EXPLORATION (15 min)

- Tell the learner that we will use an online calendar game on Starfall to make the plan.
- Access the game at https://www.starfall.com/h/holiday/calendar/?sn=main
- Follow the flow of the lesson before clicking "Next / ->" to continue to the next part of the game.
- Ask: What month is it now? *The answer depends on the time of the lesson.*
- Click the "play" icon and start the game. The game starts by displaying the month and year at real time.
- Click to continue. It reads the 7 days of the week (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday) on a calendar.
- Ask: What day is it today? *Allow response time.*
- Let the learner click the day on the top bar to reveal the answer.
- Let the learner hover the mouse over different days of the week and dates of the month to learn how to read and pronounce them.

EXPLANATION (10 min)

Driving Question: Can you find the date today on the calendar?

- Ask the learner:
  1. If you know it is Wed (*change it based on the actual day*) today, how can you find the date on the calendar? (R: Search on the column of dates under Wed and look for the number closest to the date yesterday etc.)
  2. What's the date for next Wed?

Table 6 (continued)

3. What's the date for tomorrow? Yesterday? *Allow the learner time to think about it and click on the dates.* 4. What are those days marked with special words/pictures? *Let the learner click the dates and explain briefly what they are if possible.*
ELABORATION (10 min) ● Click to continue. Ask the learner to drag the answers from the right column to fill in the day/date missing on the calendar. ● Ask the learner: 1. Is there any special day for this month that you wish to remember? 2. Please drag the stickers on the right to mark those special days. ● Click to continue. Ask the learner: 1. What activities do the pictures on the right represent? (R: Kite flying /canoeing/skating/ picnic etc.) *Talk about them.* 2. Which one is your favorite? *Allow response time.* 3. Let the learner choose the favorite picture. 4. Would you like to do it next weekend? (R: Yes!)
EVALUATION (10 min) ● Take out an empty calendar or draw one if needed. ● Say: Let's plan our activities for next weekend! ● Ask the learner to locate the dates of the next weekend on the calendar and let him/her make notes/drawings there to plan something.

Table 6 (continued)

- Ask the learner to plan some other activities for the rest of the week if possible.

CLOSURE

Tell the learner that we will follow the calendar planned today and he/she would be the task leader to keep track of things next week.

NGSS Aligned:

K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design

K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design

K-ESS2-1: https://www.nextgenscience.org/pe/k-ess2-1-earths-systems

Table 7: Lesson Plan 7

Lesson 7 Topic: Learning about Electricity using Simulations - PhET Virtual Lab

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: All children love doing experiments from young because of their curiosity, which greatly benefits science learning. However, parents often bypass the idea of doing experiments because of many constraints like the lack of materials, equipment or a safe place and they are not informed about the affordances of interactive simulations.
2. Science Learning: Young children generally have difficulty visualizing the abstract concept of electric current in electricity.

The physical constraints that hinder parents from encouraging their children's science experimentation at home are understandable, though some experiments can be done with very simple daily household materials. The problem is experimentation is a proven powerful discovery process for science and helps to engage children in deep learning of the subject. Parents should instead encourage children to do experiments to help build on their curiosity. How to enable parents to do so without having to worry about physical materials or places needed for the experiments? Computer simulations like what PhET provides have helped a great deal in this aspect. PhET which initially stood for Physics Education Technology was founded at the University of Colorado

Table 7 (continued)

and aimed to provide free educational simulations to enhance the learning of science. Over the years, PhET has expanded to other disciplines and created many interactive resources popularly used by educators across the world. Lesson 7 will demonstrate the impact of such simulations for learning using one of the simulations called Circuit Construction Kit or CCK virtual lab (https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html). This simulation allows learners to connect circuit components and construct circuits as needed in a virtual lab. It also helps children visually see the moving current through a circuit when turned on and make connections to other abstract concepts of electricity. The YouTube video here shows how the circuit components may be connected virtually: https://youtu.be/dALtroXmNIQ Quick Facts About Electricity ● Light bulbs can light up only when there is electric current flowing through it. ● Electric currents are driven by an energy source, in this case, a battery. ● To make a bulb light up, we need to connect the two terminals of a battery through wires to the two ends of the bulb. ● A switch should be connected in between the battery and the bulb to turn the current on or off (light on or off for the bulb).
Materials: ● Computer with internet access/smartphone (Android or iOS) ● CCK Virtual Lab: https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html)

Table 7 (continued)

Learning Objective(s):

- State the simple components (battery, light bulb, wire, and switch) needed to build a circuit and light up a bulb.
- Connect the simple components in a circuit on CCK to light up a bulb.
- At the end of the activity, relate the lighting of a bulb to the consumption of energy and conclude the importance of switching off the light whenever not in use.

ENGAGEMENT (5 min)

- Ask the learner while pointing at a light bulb on the wall at home:
  1. Have you ever wondered why a light bulb lights up when we turn it on? *Allow free response time and encourage ideas.*
  2. What are the things needed to light up the bulb? (R: Electricity, wires, switch, etc.)
  3. Do you think light bulbs need the energy to light up? (R: Yes!)
- Tell the learner that we would get to see what happens inside the bulb when turned on today by using a computer simulation from PhET.

EXPLORATION (10 min)

- Access the simulation at https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html
- Let the learner explore the components on the screen, but mainly introduce these four: wire, battery, light bulb, and switch.

Table 7 (continued)

- Let the learner drag some of the components onto the screen and join the ends together.
- Click the yellow refresh button on the bottom right corner to reset the screen once the learner knows how to connect the components.
- Ask: How can we connect them together to light up the bulb? *Offer some hints by relating to what is needed.* (R: The bulb would light up when all components are connected in a closed circuit like a circle as what you saw in the YouTube video.)
- Let the learner try for a few minutes and offer some help to finally connect the circuit and turn it on. The electric current (moving charged particles) should be moving around the circuit.

EXPLANATION (5 min)

Driving Question: Why is the battery needed?

- Ask while the electric current continues to move around the circuit:
    1. Why do you think we need to connect the battery to the bulb? (It gives the bulb the energy.)
    2. What are the small particles moving around the circuit? (Electricity/electric current)
    3. What happens to the current when we turn the switch on/off? (On: moving; Off: stop moving. The moving current helps to light up the bulb. For them to go on moving, they need energy from the battery.)

Table 7 (continued)

ELABORATION (10 min)

- Ask the learner:
  1. Why do we need the switch in the circuit? (R: To turn it on and off.)
  2. Why do we want to turn it off? (R: The lighting bulb uses energy, so it saves energy if we turn it off when not using the bulb.)
- What will happen if we add another bulb into the circuit? *Let the learner connect another bulb in the same circle and see that the bulb would be dimmer.*

EVALUATION (15 min)

- Let the learner construct any circuit he/she wants to, but only with one condition: to light up a bulb and make it brighter than the previous experiments. (R/One way: connect another battery in the same circle joined with the first battery and the bulb would be brighter with greater power supply.)

CLOSURE

Tell the learner that we need to remember turning off the lights whenever not in use!

NGSS Aligned:

K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design

K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design

K-2-ETS1-3: https://www.nextgenscience.org/pe/k-2-ets1-3-engineering-design

4-PS3-2: https://www.nextgenscience.org/pe/4-ps3-2-energy

Table 8: Lesson Plan 8

Lesson 8 Topic: Learning about Hydration using children's News Website - NBC News Learn

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: Reading or watching news would be a great platform to help children become informed and cultivate an interest in current affairs, but parents often struggle with which digital media sources are good for young children.
2. Science Learning: Young children are constantly reminded about the need to drink enough water, but they are often not convinced about why water is so important for the human body.

With so many online news channels and resources available for children to learn about the world, knowing the tips to assess and filter the right channel and content for the children is critical. Recognizing the need to address this issue, Common Sense Media, a well-trusted website by educators and parents worldwide, provides many useful media literacy resources to teach parents how to assess media source and content. The website (https://www.commonsensemedia.org/lists/best-news-sources-for-kids) has also identified for parents a list of quality news sources for young children. Parents may always refer to this website to try out a news source since all the sources have been professionally rated. This lesson explores one of the recommended news sources

Table 8 (continued)

called NBC News Learn website (https://www.nbclearn.com/portal/site/learn/about). NBC News Learn is a branch of NBC News and digitalizes tones of stories from a news archive and turns them into educational materials for education. The news video selected for this lesson allows young children to watch real-life news related to the topic of hydration and the importance of water to the human body. Since the information comes from a conversation between the news host and a professional doctor explaining the consequences of dehydration with real-life evidence, children may be more convinced about the importance of hydration.

Quick Facts About Hydration

- About 60% of our body is made up of water.
- Our body loses water constantly due to perspiration, digestion of food, breathing, etc. We need to refill it by drinking water.
- We get water from water and foods like fruits and vegetables.
- We need about 8 cups of water each day.
- Water goes through our mouth to the intestines and to the cells of all parts of our body to help the cells work. If dehydrated (not enough water), the cells would not work well and we would feel unwell (headache, dizzy and cramping, etc.).
- A sign of dehydration is feeling thirsty, so we should not wait till we feel thirsty to drink water. Another sign of dehydration is the color of urine turning darker. Normal urine color should be light yellow and clear.

Materials:

- Computer with internet access/smartphone (Android or iOS)

Table 8 (continued)

- News video: https://www.nbclearn.com/portal/site/learn/cuecard/117843
- Notebook and writing materials (pencil, eraser, etc.)

Learning Objective(s):

- State the amount of water content in our body and the ways to identify signs of dehydration.
- Explain the importance of water to the human body by relating dehydration to possible consequences.
- Create a simple story with short writing and illustrations about a character getting dehydrated and what he/she must do to feel better.

ENGAGEMENT (5 min)

- Bring two cups of water and ask the learner to drink together.
- Ask the learner:
  1. Why do you think I keep asking you to drink water each day? (R: It helps us stay healthy.)
  2. Do you know why it is so important to our body? Let's watch a piece of news to find out!

EXPLORATION (5 min)

- Access the news video at https://www.nbclearn.com/portal/site/learn/cuecard/117843
- Pause at 0:25 seconds and ask the learner:
  1. How much of our body is made up of water? (R: 60%)

Table 8 (continued)

2. How does our body lose water? (R: Sweating, breathing, digesting food, etc.)
EXPLANATION (5 min) ● Play again and pause at 1:15 seconds to ask: What is dehydration? (R: Not getting enough water in the body.) ● Play again and pause at 1:56 seconds to ask the learner: 1. How many cups of water do we need daily? (R: 8 cups) 2. What can happen if we are dehydrated? (R: Feeling dizzy, headache, cramping, etc.)
ELABORATION (5 min) ● Play again till the end and ask the learner: 1. How to tell if we are dehydrated? (R: Feeling thirsty, the color of pee turning darker yellow.) 2. Should we wait till thirsty to drink water? (R: No, it would mean we are already dehydrated. Drink 8 cups a day.) 3. Where else can we get water? (R: Fruits, vegetables, juices, etc.)
EVALUATION (25 min) ● Let the learner think of a character that does not like drinking water and what happens to him/her. Talk about what the person should do to get healthy. ● Recall the keywords learned in this lesson and help the learner write down on the notebook.

Table 8 (continued)

- Ask the learner to write and draw a short story about the character discussed.

CLOSURE

Tell the learner that we need to remember drinking 8 cups of water each day from now!

NGSS Aligned:

K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design

K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design

K-2-ETS1-3: https://www.nextgenscience.org/pe/k-2-ets1-3-engineering-design

K-LS1-1: https://www.nextgenscience.org/pe/k-ls1-1-molecules-organisms-structures-and-processes

Table 9: Lesson Plan 9

Lesson 9 Topic: Learning about The Parts of a Plant using Digital Story-Maker - My Storybook

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: One of the main digital literacy skills required of children today is to create instead of just consume digital information. Parents often do not know enough about digital creating tools because they think such tools are too high level for young children.
2. Science Learning: Most children love learning life science because they can relate the concepts to real life easily, but many find it hard to remember the facts especially when the terms used are more alien to daily life (e.g., the names of the parts of a plant).

There are tons of digital tools allowing young children to create a product nowadays, including drawing, story-making, movie-making, photo-taking, etc. Story-making tools would appeal to young children well because children like listening to stories and love telling or making their own stories even more. My Storybook (https://www.mystorybook.com/) is a perfect free online tool designed primarily for young children to create their own digital books that can be shared with others and even printed into hard copies to keep forever. This is one of the most useful tools that

Table 9 (continued)

can be incorporated into almost every daily activity for the children. Children can use it as a platform to summarize and capture whatever they have learned or wish to remember. Research has shown that narrative helps with memory retention (https://www.edutopia.org/article/neuroscience-narrative-and-memory). Story-making also allows children to learn how to plan, organize and create information. At the end of the lesson, parents get to experience the comfort of using creating tools to guide children's learning and the children would be able to remember the parts of a plant much more easily than before.

My Storybook has a relatively simpler interface which is easier for younger children (5-7) to manage. Once the children get very comfortable with this tool and wish to use one with more features and props, Storyjumper (www.storyjumper.com) would be another good choice. The YouTube video here introduces the features of My Storybook: https://youtu.be/shnIaMDFZUk

Quick Facts About the Parts of a Plant

- The flowers make the seeds for the plants so that more plants can be grown from the seeds.
- The leaves make food for the plant using light energy from the Sun.
- The stem helps to transport water from the roots to the other parts of the plant.
- The roots take in water and minerals from the ground and hold the plant tight to the ground.

Materials:

- Computer with internet access/smartphone (Android or iOS)
- My Storybook tutorial: https://youtu.be/shnIaMDFZUk

Table 9 (continued)

• My Storybook online app: https://www.mystorybook.com/
Learning Objective(s): • Name and identify the corresponding parts of the plant on a picture. • Using My Storybook, create a story to explain the functions of the parts of a plant.
ENGAGEMENT (5 min) • Ask the learner: 1. Do you know where plants come from? (R: The ground/seeds.) 2. Where do the seeds come from? (R: The flowers.) 3. Would you like to find out more about the parts of a plant by making a story for it? (R: Yes!)
EXPLORATION (5 min) • Show a YouTube video about the parts of a plant: https://youtu.be/s2r5LLy9Qaw • When finished, ask the learner: 1. What are the 4 main parts of a plant? (R: Flowers, leaves, stem, and roots.) 2. What do the parts do for the plant? *Refer to the Quick Facts.* (R: the flowers make the seeds, the leaves make food for the plant, the stem carries water up, the roots take in water and minerals from the ground.) 3. Shall we create a story for the parts of a plant? *Go to My Storybook Library under the Menu and show the learner some of the storybooks created by*

Table 9 (continued)

other children to motivate him/her.
EXPLANATION (8 min) ● Tell the leaner that we can make a story of everything we do or learn in life. My Storybook is a tool to help us do it easily. ● Ask the learner what components a storybook normally has. (R: Cover page with title and author, main story, back cover) ● Open the online tool: https://www.mystorybook.com/ ● Click "Make a storybook" on the homepage and a page called "My First Storybook" shows. ● Watch the YouTube tutorial (https://youtu.be/shnIaMDFZUk) again with the learner so that he/she may have a feel of what the interface and tasks would be like.
ELABORATION (12 min) ● Go back to the "My First Storybook" page and let the learner practice: On the Left Panel 1. Highlight the text, click T to change the size, click paint drop to change color, type words to replace the existing words. *We will keep to simpler features because of this age group.* 2. Click Items to add any item. Scroll down and click All Items to see all. 3. Click Draw to choose the brush and color to draw on the page. 4. Click Text to type in some words and click Add to the story.

Table 9 (continued)

5. Click Scenes to scroll down to click All images and select a background scene.
6. Click any object on the screen and click the Trash Bin to delete.

On the Right Panel

1. Click + (Add Page) to add a page.
2. Click any page on the right column and click Trash Bin to delete.

EVALUATION (15 min)

- Ask the learner:
  1. What are you going to tell about the parts of a plant? (R: The names of the 4 parts and what they do.)
  2. How many pages shall we create then? *Keep it simple first, maybe a maximum of 7 pages in total. The learner may do more after this lesson when familiar with the tool.*
- Let the learner:
  1. Type the book title (e.g., The Parts of a Plant).
  2. Add his/her name as the author.
  3. Add a scene (with trees).
  4. Add a page and go to the 2nd page which summarizes that all plants have 4 parts.
  5. Page 3-6 can tell the name of each part and a short statement of what it does for the plants on each page.
  6. Page 7 can be the back cover.

Table 9 (continued)

7. Let the learner be as creative as possible and decorate the book he/she wants to. 8. When finished, click “Finished” and start playing the book. **CLOSURE** Tell the learner that now he is the author of a book and we will share it with our family/friends to read it.
NGSS Aligned: K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design K-LS1-1: https://www.nextgenscience.org/pe/k-ls1-1-molecules-organisms-structures-and-processes

Table 10: Lesson Plan 10

Lesson 10 Topic: Learning about Engineering Design using Coding – Scratch Jr

Duration: 45 minutes **Subject / Grade Level:** Science / Kindergarten

Introduction:

Problems to be Addressed

1. Digital Literacy: Parents spend lots of money to send their children for after-school coding lessons because they universally perceive coding as something exceptionally difficult and do not know how to start teaching it to the children.
2. Science Learning: Engineering design is an important skill for all, but often not well emphasized because of the perceived difficulty in implementing it for young children.

Engineering design is essentially a process of identifying a problem and generating a model or solution to solve the problem. Such a process allows learners to critically gather, process, analyze and evaluate information. These are important skills that will benefit the learners in all aspects. Coding is a way to facilitate engineering design and it helps children develop literacy, numeracy, and logical thinking skills. It was once thought of as something very difficult and only meant for a small group of people gifted to do it. The introduction of many coding programs and applications for children has reshaped the way people view and learn to code. ScratchJr is one of the revolutionary coding apps developed by MIT for younger children to create interactive animations and games using simple coding. It is free and available for tablets (Android

Table 10 (continued)

or iOS) and Chromebook. This lesson demonstrates how this fascinating app can help young children design a solution to solve a given problem through computational thinking. At the same time, parents get to experience how easy teaching coding actually can be for children using age-appropriate apps like ScratchJr. The following steps help parents to familiarize themselves with ScratchJr (each step takes less than 5 minutes): ● Watch a ScratchJr YouTube tutorial: https://youtu.be/ciWPaEgscr0 ● Read the Interface Guide (https://www.scratchjr.org/learn/interface) and click each number on top to discover the icons of the app. ● Read the Paint Editor Guide (https://www.scratchjr.org/learn/paint) and click each number on top to discover the features of the paint editor. ● Read the Block Descriptions (https://www.scratchjr.org/learn/blocks) and click each number on top to discover the functions of the coding blocks. ● For more tutorial videos, please visit https://www.scratchjr.org/learn/tips
Materials: ● ScratchJr app for Chromebook: https://chrome.google.com/webstore/detail/scratchjr/oipimoeophamdcmjcfameoojlbhbgjda?hl=en ● ScratchJr app for iOS: https://itunes.apple.com/us/app/scratchjr/id895485086?mt=8 ● ScratchJr tutorial: https://youtu.be/ciWPaEgscr0 ● ScratchJr Sunset Animation: https://www.scratchjr.org/teach/activities/sunset

Table 10 (continued)

Learning Objective(s):

- Design the logical steps to solve a given problem.
- Create an animation to solve a given problem.

ENGAGEMENT (5 min)

- Ask the learner:
  1. Do you like animations like Peppa Pig, Frozen, The Little Pony, etc.? *Name one that the learner is familiar with and talk about it.*
  2. Have you ever wondered how those animations are made? Would you like to try making one today? *Assure that learner that it can be something fun and simple.*

EXPLORATION (10 min)

- Watch the ScratchJr YouTube tutorial again with the learner: https://youtu.be/ciWPaEgscr0
- When finished, allow the learner to familiarize with the interface by completing the steps below:
  1. Ask: Can we make the Sun set? What do we need? (R: Have a Sun and make it move down.)
  2. Access the guide to make a Sunset animation here: https://www.scratchjr.org/teach/activities/sunset
  3. Create a new project.
  4. Choose a background following the guide.

Table 10 (continued)

5. Choose the Sun as the character and Press and hold to delete the cat.
6. Move the Sun to the start place at the top of the screen.
7. Make the program by adding the coding blocks in the guide. *Start on Screen Flag, Move Down 3 steps, Hide, Stop.*
8. Tap the Green Flag at the top of the screen to show the animation.

EXPLANATION (10 min)

- Tell the leaner that coding is a way the computer tells objects on the screen to move in the way we wish.
- Ask the learner:
  1. How do we add an animal to live in the park? (R: Add an animal character.) *Let the learner try it out.*
  2. How do we make the animal disappear when the Sun sets? (R: Make the animal Wait for probably 6 seconds and then Hide.) *Hint to the child that the animal needs to first wait till the Sun sets before hiding itself.*
  3. Let the learner try out the solution.

ELABORATION (5 min)

- Refer to another activity provided by ScratchJr: https://www.scratchjr.org/teach/activities/moonrise-after-sunset
- Ask the learner:
  1. Can we add another page so that the Moon rises after the Sun sets? (R: Yes. Click + on the right panel to add another page.)

Table 10 (continued)

2. What should be the steps to make the Moon rise? (R: Choose a night scene, Add a Moon and move it to the bottom of the screen, Move up some steps).

EVALUATION (15 min)

- Ask the learner to add another page after the first page for sunset.
- Let the learner work out the steps discussed earlier to create the Moon rising scene after Sun setting. *Offer help wherever needed.*
- Play the animation when completed.

CLOSURE

Tell the learner that creating animation can be quite easy. We always start by thinking about what we want to create and then plan the steps to make the objects or scenes move around.

NGSS Aligned:

K-2-ETS1-1: https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design

K-2-ETS1-2: https://www.nextgenscience.org/pe/k-2-ets1-2-engineering-design

K-2-ETS1-3: https://www.nextgenscience.org/pe/k-2-ets1-3-engineering-design

Chapter 4: Conclusion

The 10 lesson plans for parents to guide their children's technology use and science learning at home have been successfully developed and tested with a small group of children of the intended age from my immediate family. Results show that young children are not only able to appreciate science concepts and relate to their daily life experiences, they also master new types of digital technology. Some of the comments frequently made by the children are "This is so cool!," "Science is fun!," and "Can I do it again tomorrow?" A group of parents surveyed for another related project indicated strong interest in the development of resources such as these lessons to help them better engage in their children's education. The response of the parents in the previous survey is not surprising because there had been substantial research-based evidence discussed in the literature review surfacing the need for this type of resources for the parents, and strong theoretical background supporting the development of the lesson plans in the areas of technology integration, pedagogy approach, and content knowledge. Through the use of the curriculum developed in this report, parents may develop higher confidence in becoming their children's digital mentors and science learning partners, be more informed about the affordances of technology, leverage technology's benefits instead of worrying about passive screen time, and stay motivated to be involved in children's education.

LIMITATIONS

Testing with Parents

One of the main limitations of this project is the lack of time and scope of the project to conduct thorough testing of the lesson plans with a significant number of parents and children, especially those from disadvantaged families who might potentially benefit more from such resources. Feedback from parents would provide first-hand information about

the clarity of the lesson instructions and difficulties faced by them when using the lesson plans, which in turn would help the revision and refinement of the lesson plans guided by the last three steps of the TTIPP model (Roblyer & Hughes, 2019).

Access to Technology

Although conscious efforts have been made to ensure the accessibility of the types of technology used in the lesson plans by deliberately choosing free resources/applications available on a variety of devices, internet access is still one of the key requirements for most of the technology types chosen. The need of internet access might intimidate the group of parents having limited access to high-speed or stable internet from home, though much effort and achievements have been made to address the access gap as mentioned in the literature review.

RECOMMENDATIONS AND FUTURE DIRECTIONS

In order to further evaluate the effectiveness of the curriculum package developed and make improvements, it is necessary to engage parents and children in the testing of the lesson plans to provide feedback for all 10 lessons. One way to facilitate that could be through collaboration with schools, public libraries, and community centers to publicize a series of blended workshops for parents and their children and let them try out the lessons during the workshops. Through the initial workshops, we could achieve a few objectives simultaneously:

1. Advocating the importance of parental engagement and digital mentoring in children's education.
2. Providing information about free public access to the internet and digital devices.

3. Giving an overview of the curriculum package and assure parents about the ease of using it.
4. Engaging parents in possible future research studies in a related topic.

One possible future research is to examine the effect of technology-infused science education workshops for parents on their confidence in guiding their children's science learning and technology use at home by conducting a quantitative study using survey design. It would also help learn the potential impact on their degree of involvement in their children's education and inform the scholarly community as well as policymakers about the kinds of effective interventions and support for parents in order to collectively address the digital usage gap and scarcity of science education resources. The research procedures may consist of the following steps:

1. Defining the measures of the variables involved. For the confidence level on guiding their children, a Teacher Confidence Scale with Likert-scored items from Ohio State University (Hoy, 2000) can be adapted and used. Some sample statements in the adapted scale may be “I am confident in my ability to teach my children science at home” or “I am confident in my ability to mentor my children’s technology use for science learning.” Degree of parental involvement may be measured by the number of school activities and the frequency at which parents are engaged in those activities for their children (Ma et al., 2016).
2. Conducting a pre-survey with the participants to understand their self-reported level of access to digital resources and science education resources at home, their confidence level on guiding their children’s science learning and use of technology, as well as their degree of involvement in their children’s education.

3. Conducting fortnightly technology-infused science education workshops using the curriculum package, encouraging parents to practice what they learn at home and provide feedback during the subsequent workshop.
4. Refining the upcoming workshops/lesson plans incorporating participants' feedback along the way as and when it arrives.
5. Conducting a post-survey to assess their confidence level on guiding their children's science learning and technology use, as well as their degree of involvement in their children's education. Qualitative interviews may be followed to take a deeper understanding of specific issues gathered from the research.

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